Bridging Social and Environmental Justice: Mapping the Geography of Environmental Segregation in Columbus, OH

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Contents

Note: Citations are by slide number at end of presentation.

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- Literature Review
- Methods
- Analysis Results
- Discussion
- Questions

Naïve question:

“Why do some neighborhoods have so few/many trees?”

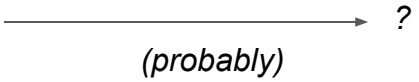
5 months later...

Research question:

“Is there a measurable relationship between environmental assets & socioeconomic vitality?”

5 more months of research...

Secondary exploration:
“Is discrimination driving the environmental disinvestment seen in some parts of the city?”



Literature Review

1. The Development Conflict
2. Socioeconomic Assessment
3. Environmental Assessment
4. Environmental Justice

“This may be the most challenging conundrum of sustainable development: how to increase social equity and protect the environment simultaneously…”

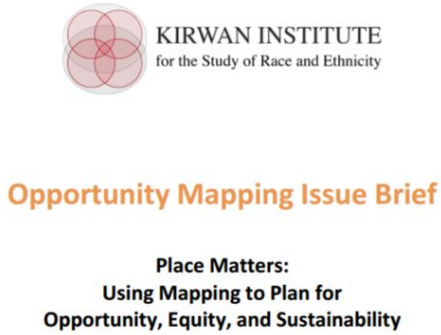
- *Scott Campbell (1996)*

1. The Development Conflict

General Goal
Socioeconomic metrics were developed to monitor economic development, and later, equity.

How It's Measured
US Census surveys are primary source of data, modern metrics incorporate health and other indicators.

Kirwan Institute's Opportunity Index
Developed by Reece et al., rates the predicted life outcomes of children in different neighborhoods based on standard deviations from city mean in several indicators.



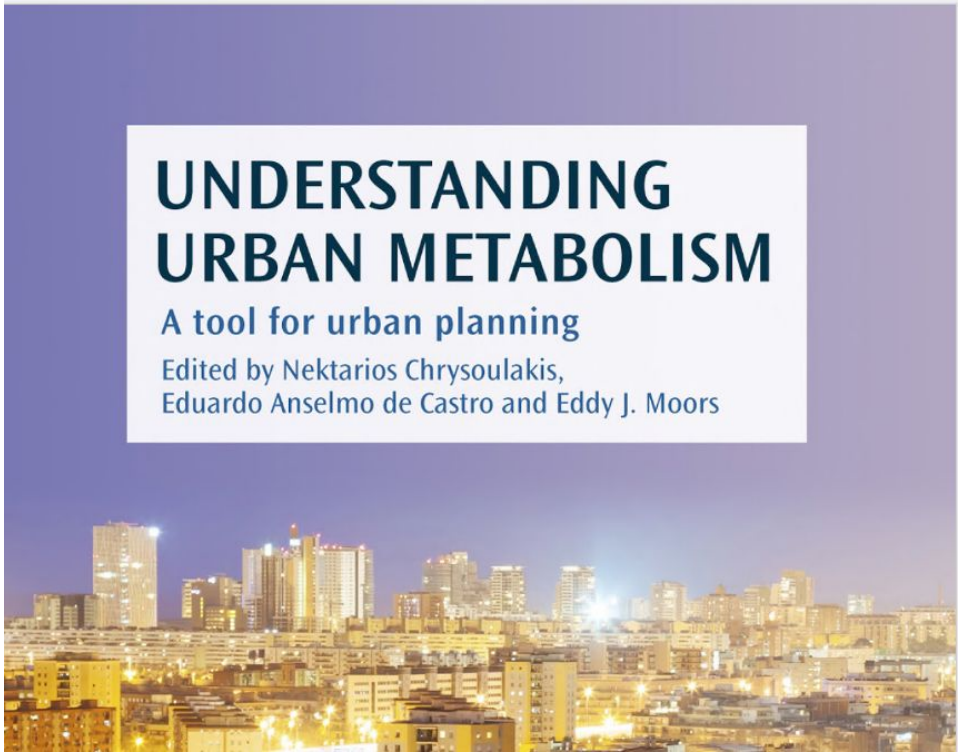
Source: Reed, Jason et al. (2013).

2. Socioeconomic Assessment

General Goal
Environmental metrics were developed first to monitor pollution and ecological stress, young science of asset and biodiversity tracking.

How It's Measured
Remote sensing data dominates due to accessibility, as on-the-ground measurement is very expensive.

Trees and Impervious Surface
We chose to investigate tree canopy and impervious surface coverages as a result of in-person experience in Bexley.



Source: Chrysoulakis, Nektarios et al. (2015).

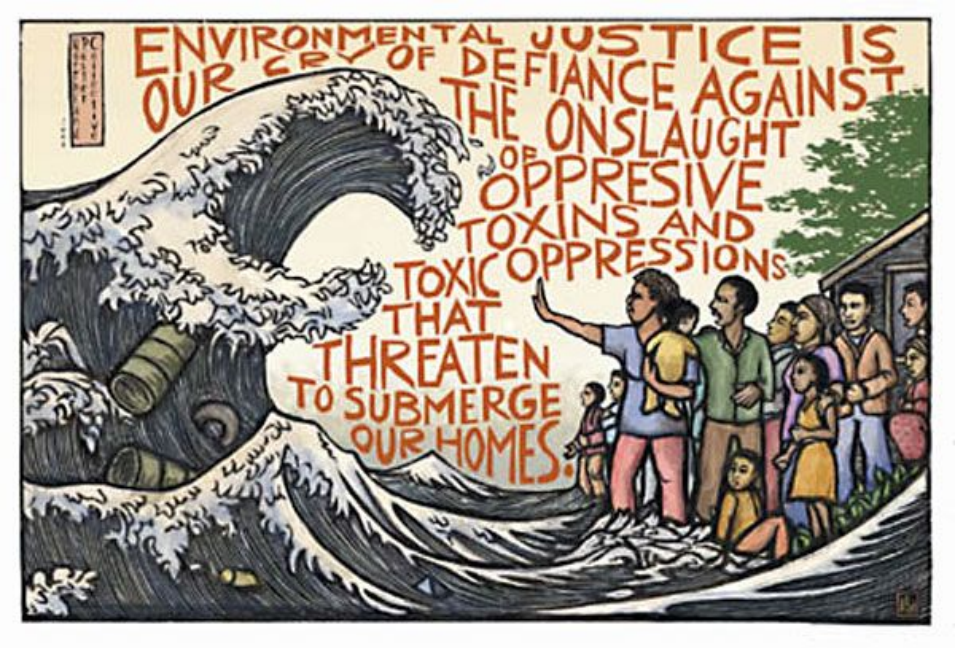
3. Environmental Assessment

Introduction | **Lit. Review** | Methods | Analysis | Discussion

Robert Bullard
One the founding intellectuals of the Environmental Justice movement, Bullard has mapped the unfair placement of pollution sources.

Julian Agyeman
A student of Bullard, Agyeman (among others) has built more holistic vision of “just sustainability” on top of work of Environmental Justice.

The Need for Asset-Based Metrics
A vast majority of the literature and nearly all practically used metrics are based on pollution and other liabilities.



Source: http://www.columbia.edu/cu/EJ/EJ_ricardolevinsmorales.jpg

4. Environmental Justice

Methods

Examples of each analysis type.

1. Indicators
2. County mapping
3. Correlation tests
4. Cluster analysis
5. Age cohorts
6. Bivariate mapping
7. Case study

Census Tract Shapefile
Base geometry file, contains WP and VH as well. From *Census.gov*

Kirwan Opportunity Index (OI)
Composite metric of socioeconomic vitality at tract level. *From DiversityDataKids.org*

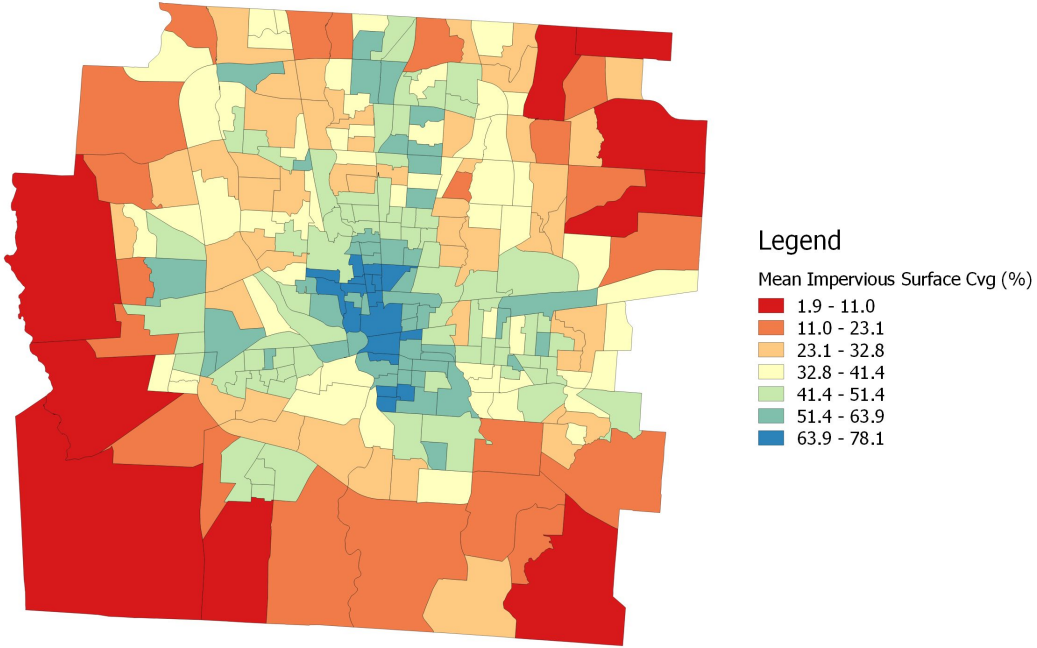
Mean Canopy Coverage (MCC)
Calculated from raster dataset of national tree cover. *From USGS.gov*

Mean Impervious Surface Coverage (MISC)
Calculated from raster dataset of national land use coverage. *From USGS.gov*

White Population Percentage (WP)
Calculated from census demographic data. *From Census.gov*

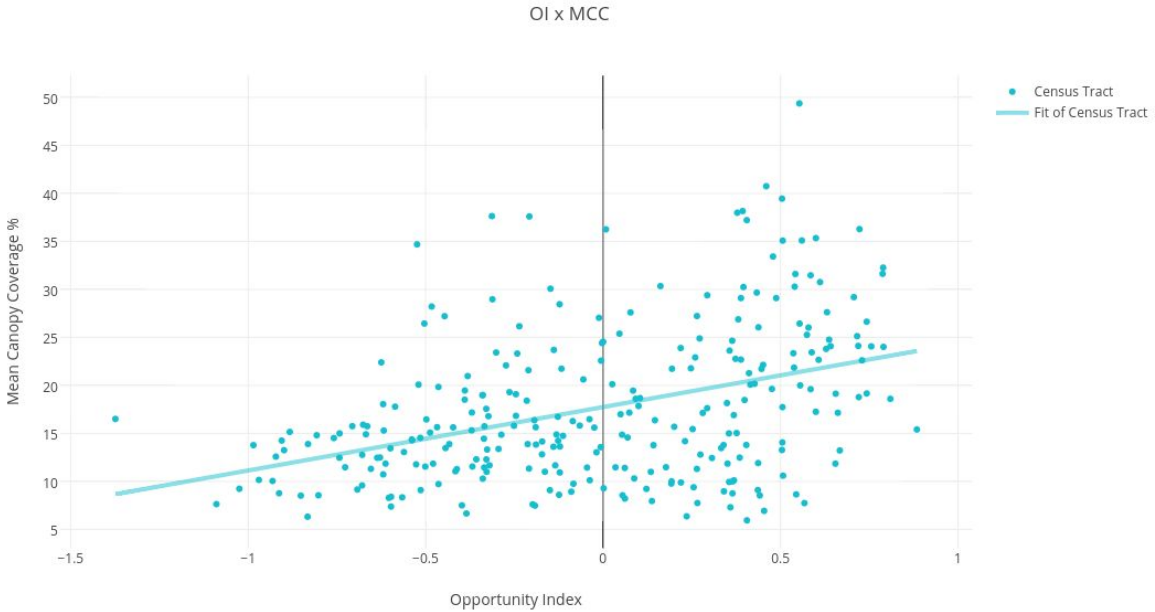
Vacant Housing Percentage (VH)
Calculated from census housing data. *From Census.gov*

Mean Build Date (MBD)
Calculated per tract to organize neighborhoods by rough age.
From FranklinCountyAuditor.com



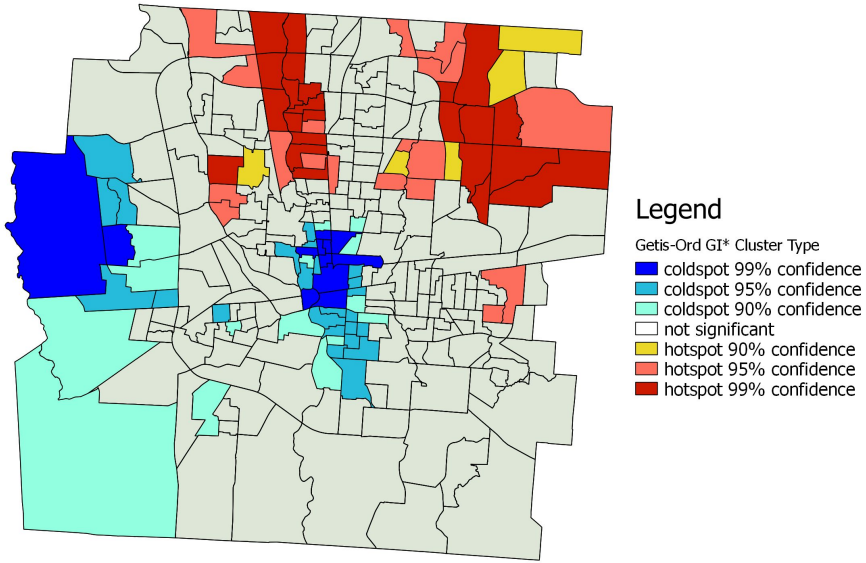
County Mapping

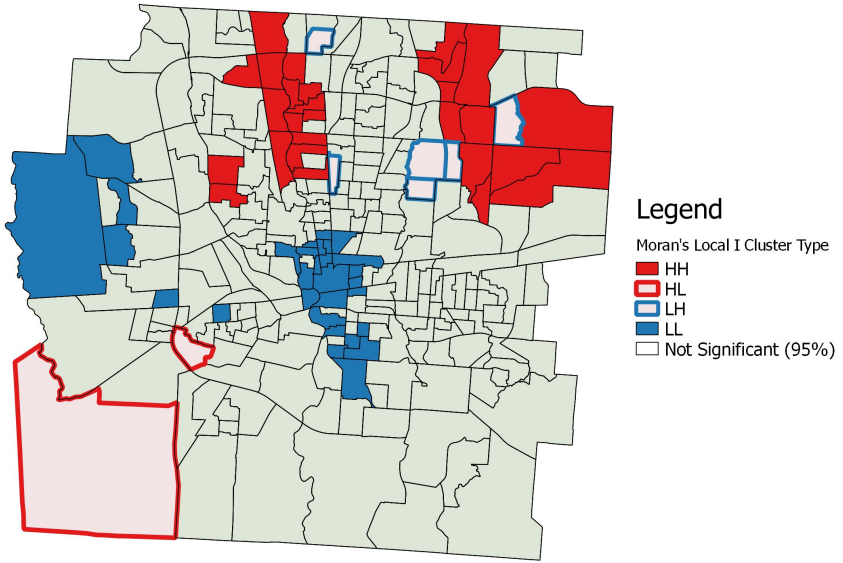
Our first goal was to map each variable to the census tracts of Franklin County. Using this we began to identify first candidates for case study, as well as cursory trends in the data.



Correlation Tests

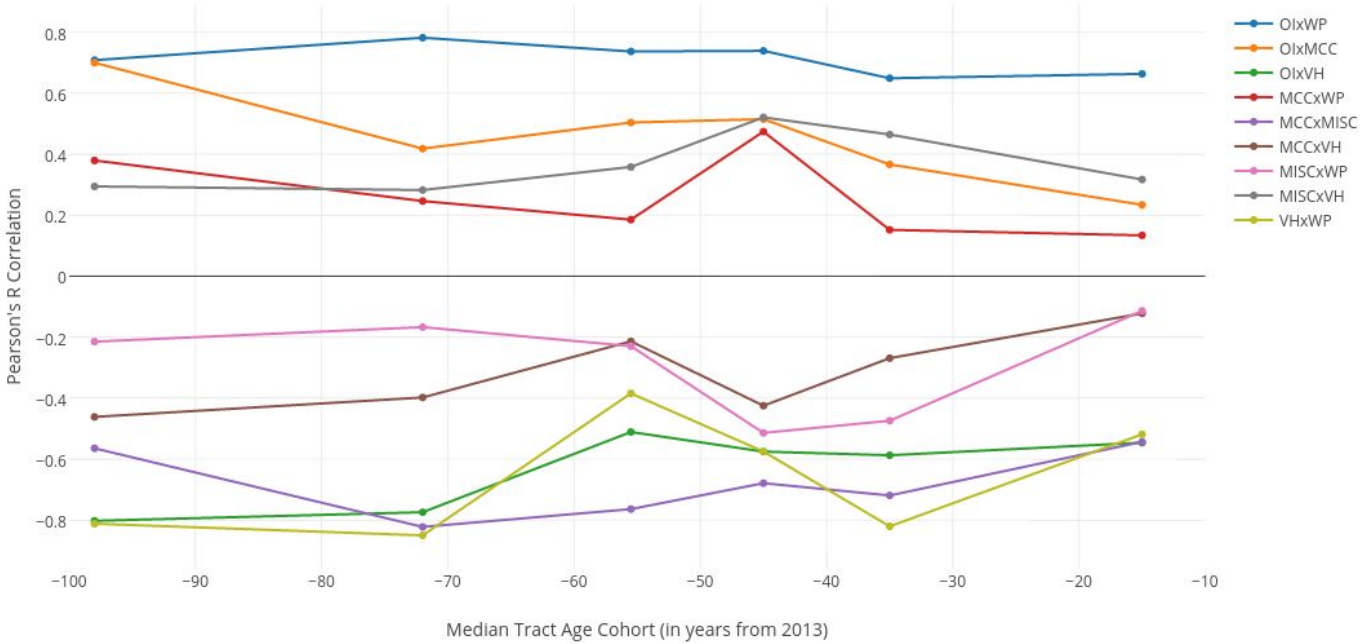
We then began to explore the statistical relationship between indicator variables by performing simple correlation tests on all combination pairs.





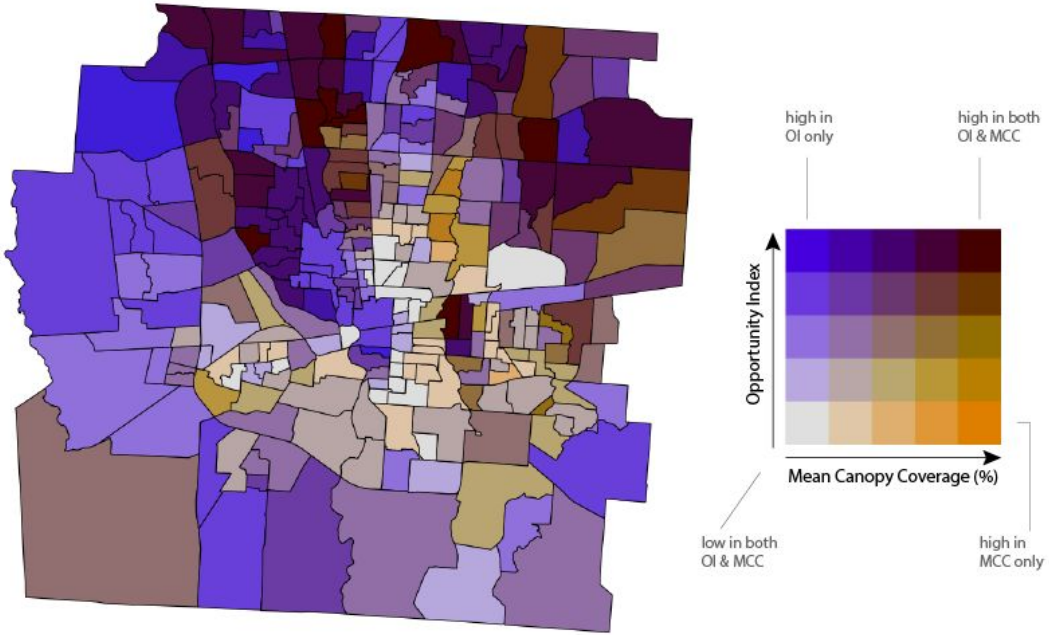
Cluster Analysis

These univariate spatial tests allowed us to map the groupings of high and low indicator values, and understand the environmental and socioeconomic landscapes of the county.



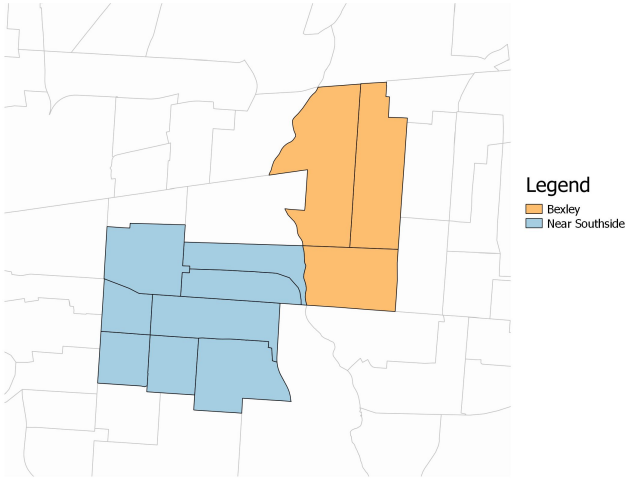
Age Cohort Correlations

This analysis explored the relationship of neighborhood age to our indicator variables. We hoped to find meaningful trends in socioeconomic/environmental alignment.



Bivariate Mapping

We explored bivariate mapping and spatial analysis tools as an exploration of current methods, but found them often lacking in meaningful communication.

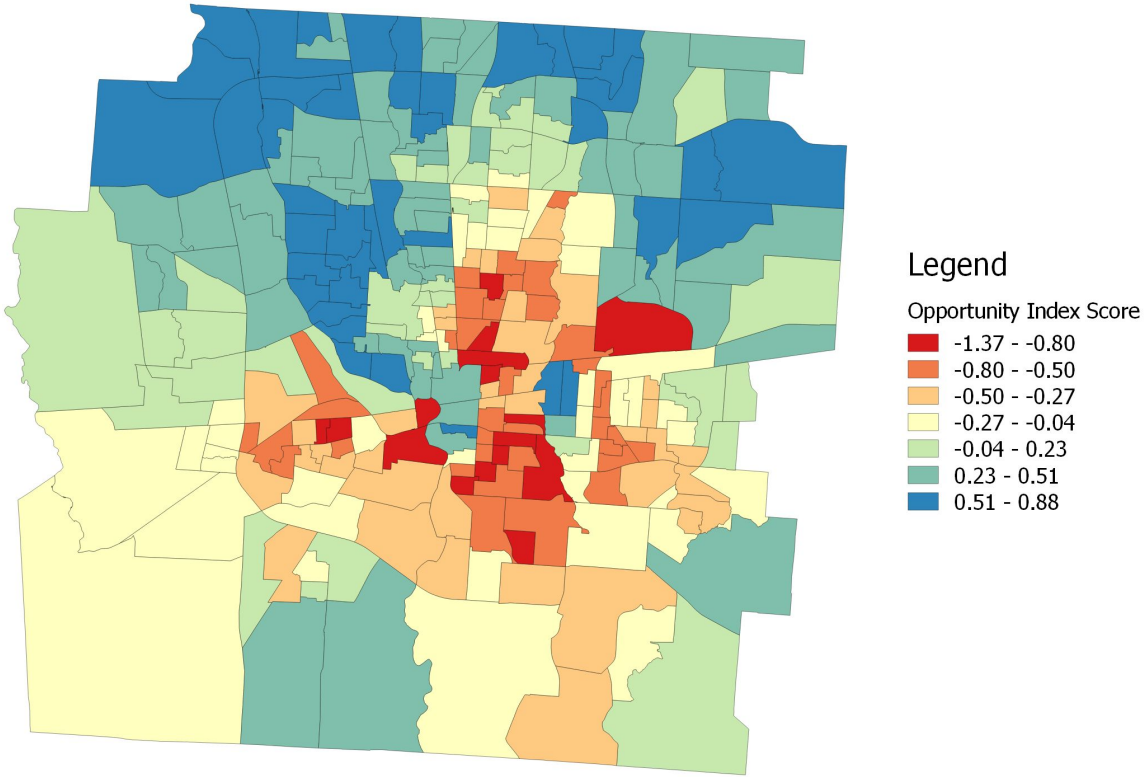


Case Study

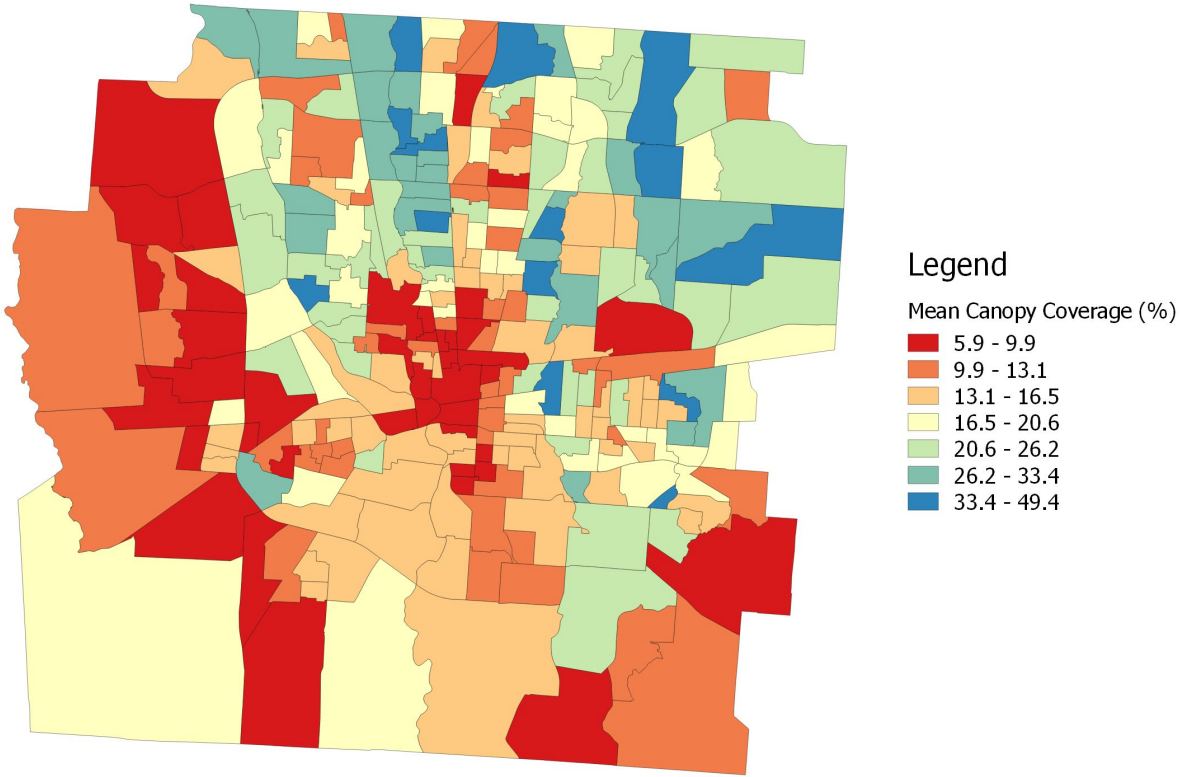
We identified Bexley and Near East as extremely contrasting “sibling” neighborhoods and explored the socioeconomic and environmental histories which may have influenced their current states.

Analysis

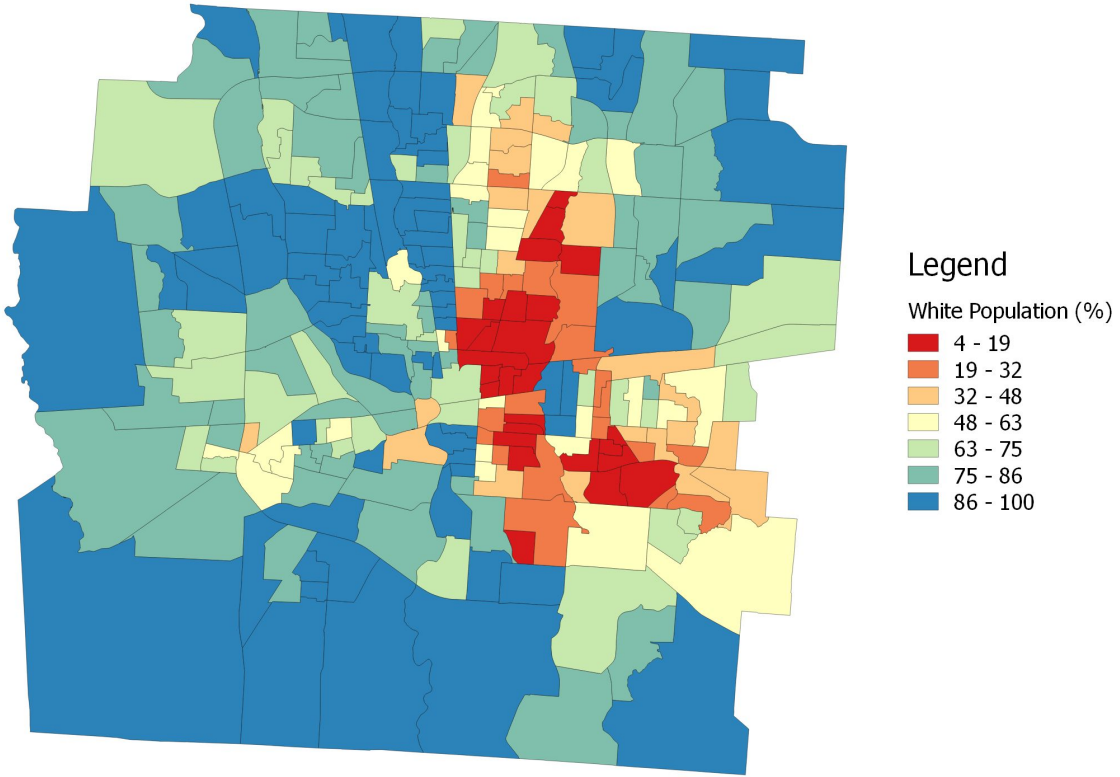
1. County mapping
2. Correlation tests
3. Cluster analysis
4. Age cohorts
5. Case study



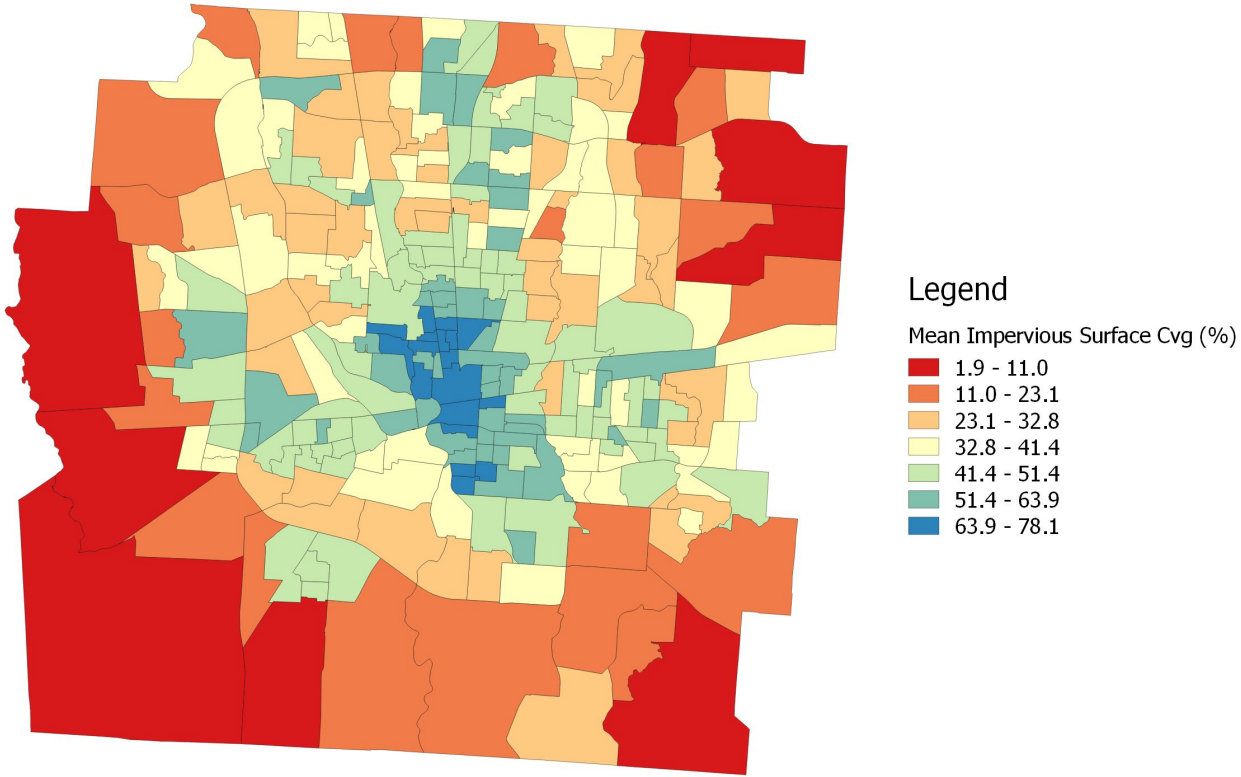
County Mapping: Opportunity Index



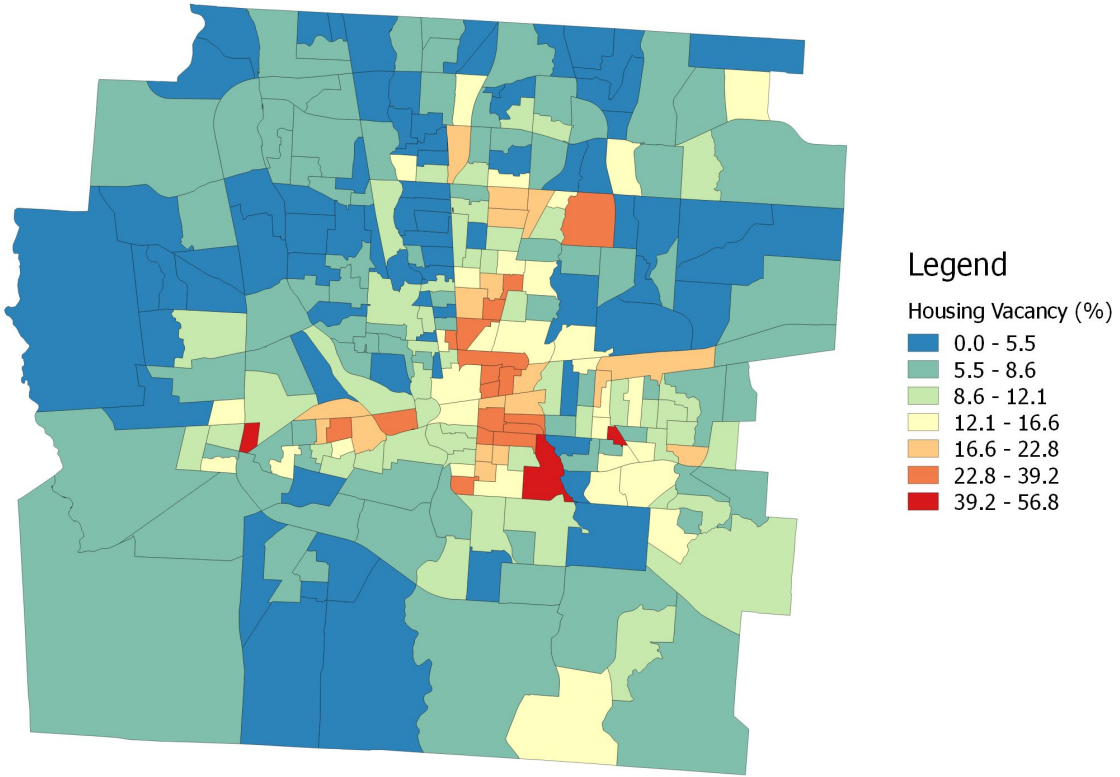
County Mapping: Mean Canopy Coverage



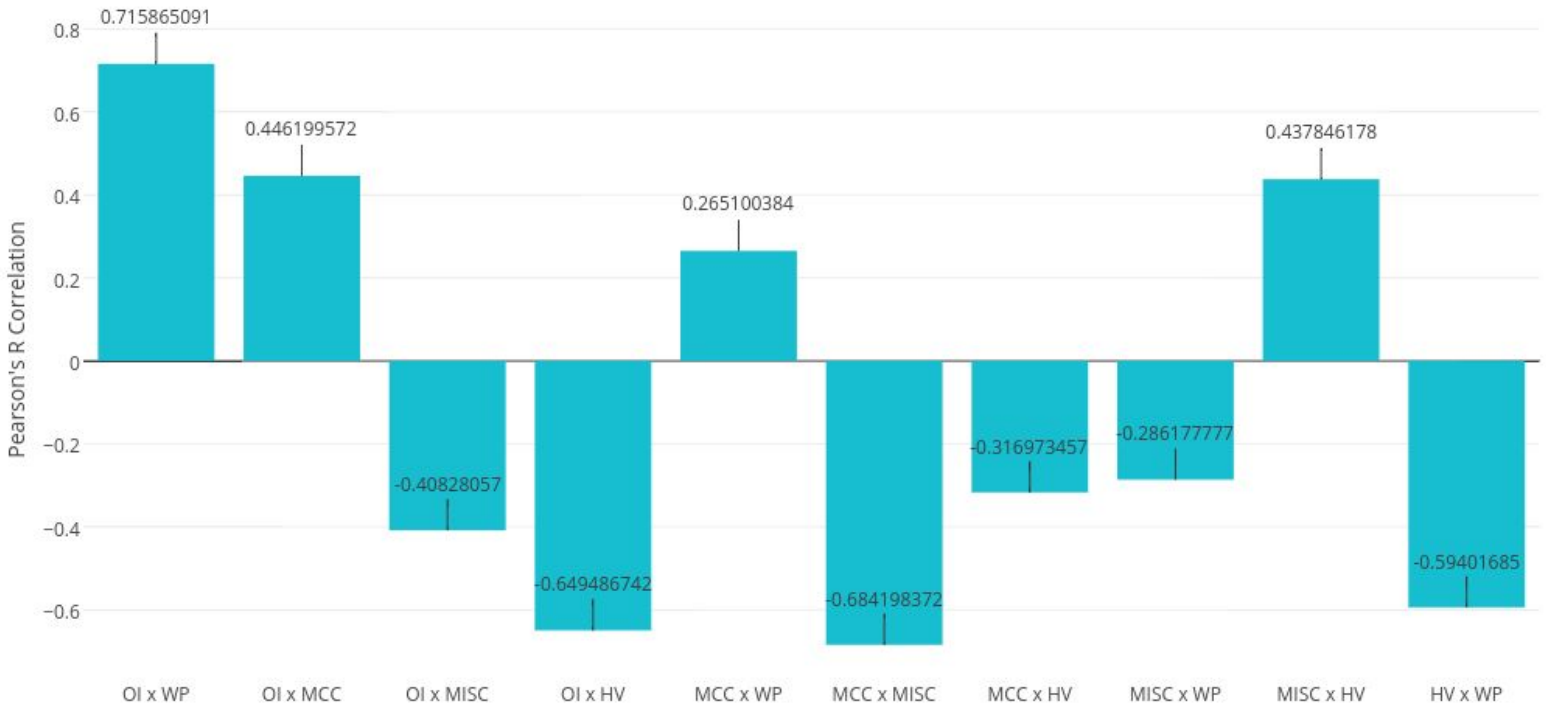
County Mapping: White Population



County Mapping: Mean Imp. Surface Coverage

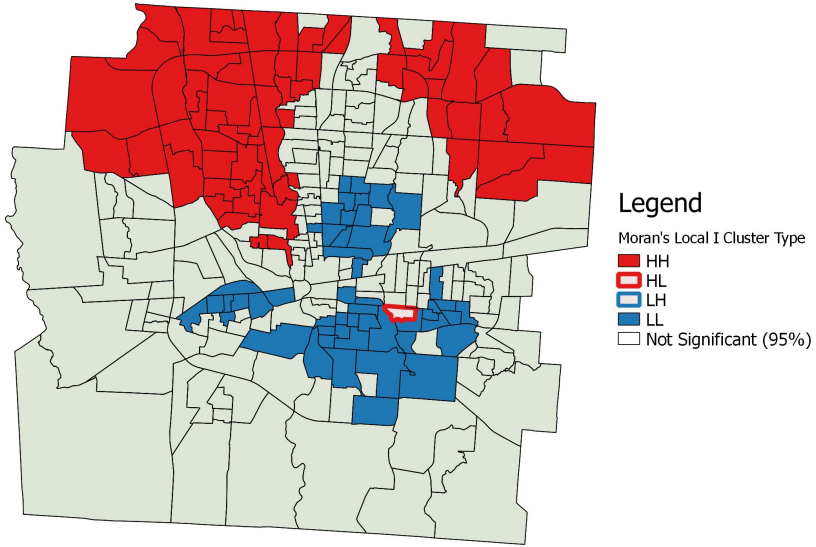


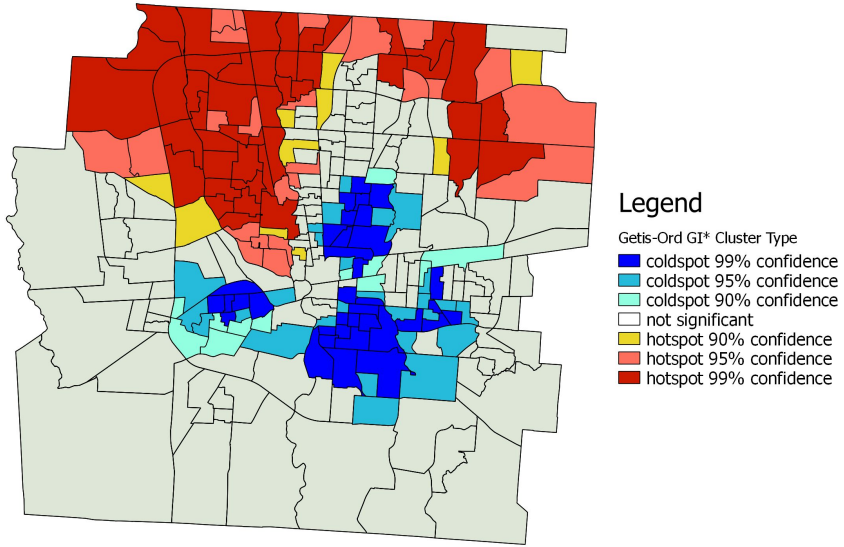
County Mapping: Vacant Housing



Correlation tests:

R values of county-wide variable pairs

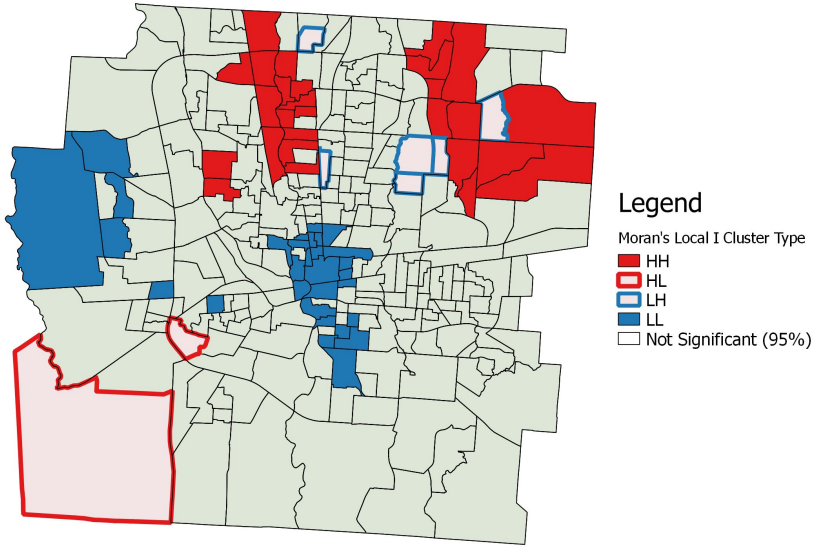


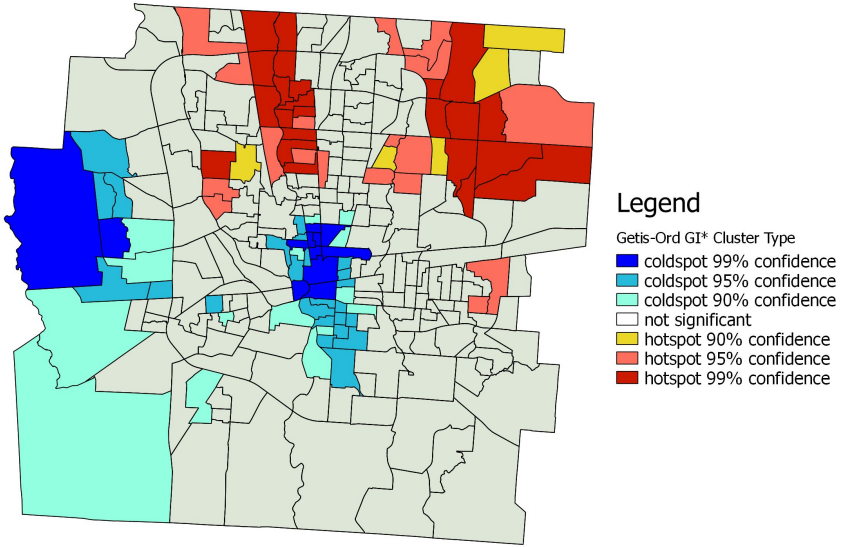


Cluster Analysis: Opportunity Index

Left: Anselin Local Moran's I = high/low clusters & outliers

Right: Getis-Ord Gi* = hot/cold spots by likelihood

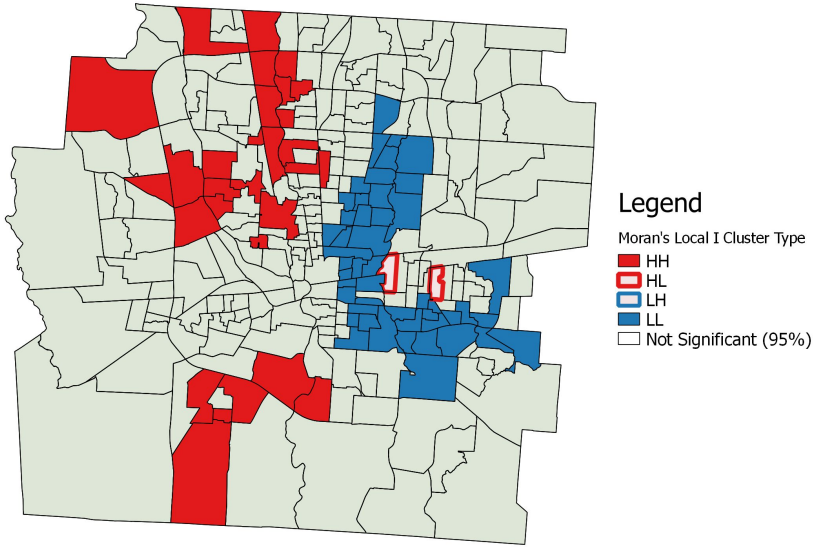


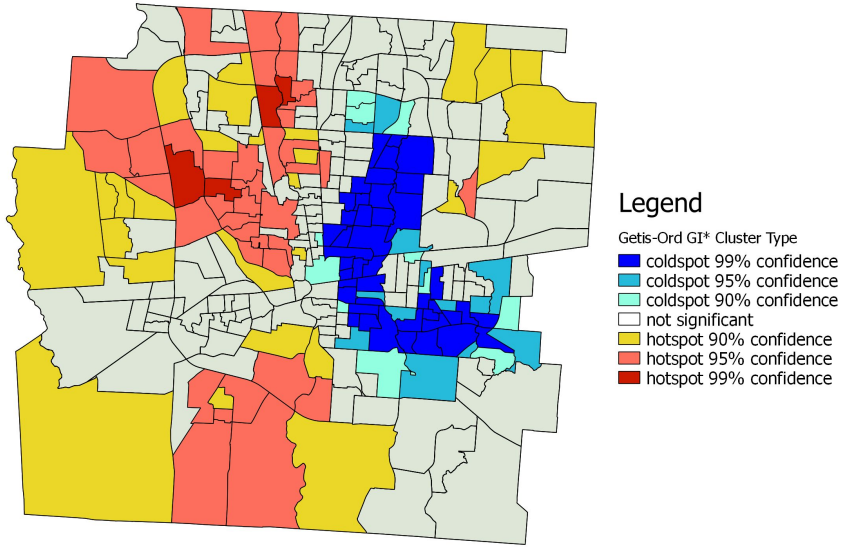


Cluster Analysis: Mean Canopy Coverage

Left: Anselin Local Moran's I = high/low clusters & outliers

Right: Getis-Ord Gi* = hot/cold spots by likelihood

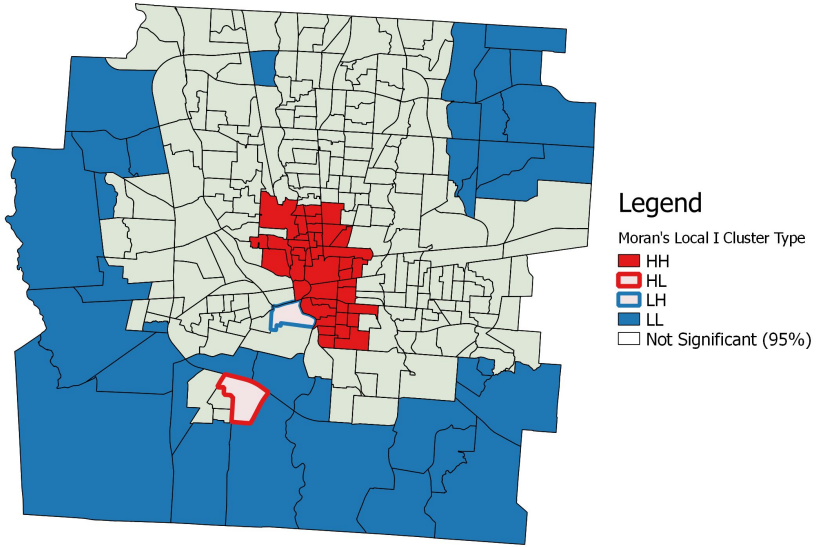


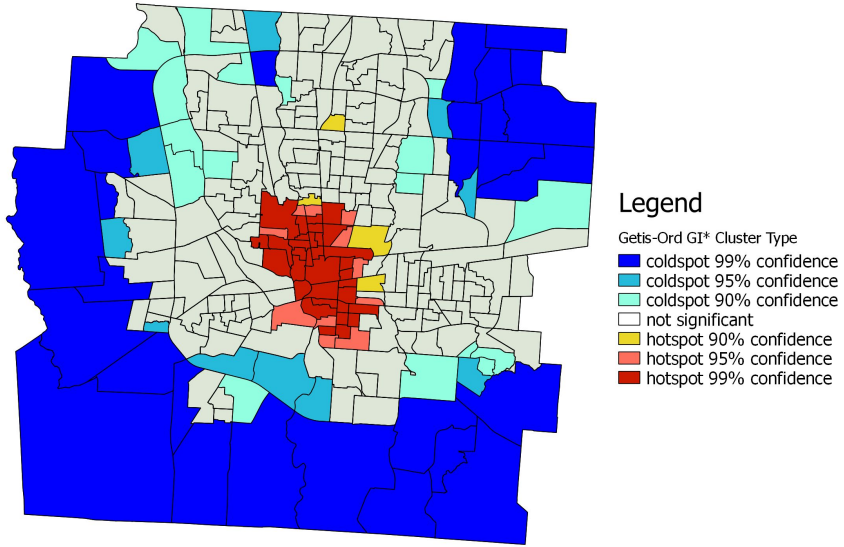


Cluster Analysis: White Population

Left: Anselin Local Moran's I = high/low clusters & outliers

Right: Getis-Ord Gi* = hot/cold spots by likelihood

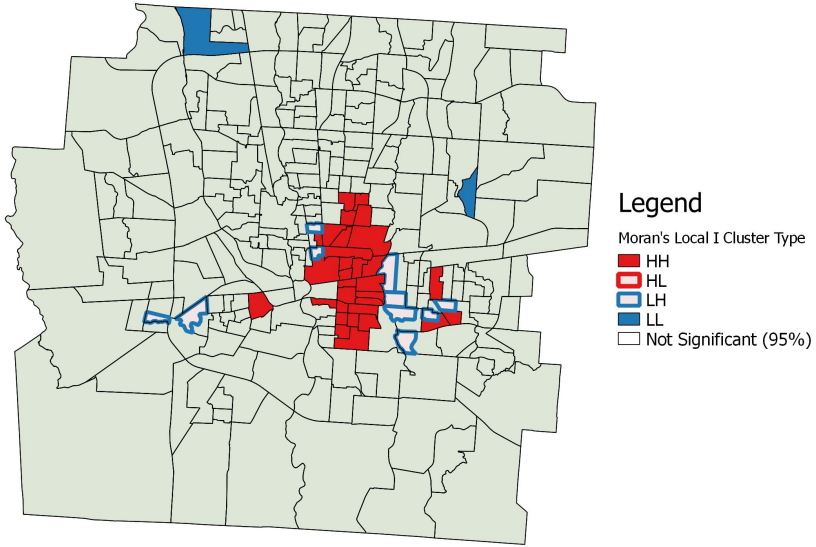


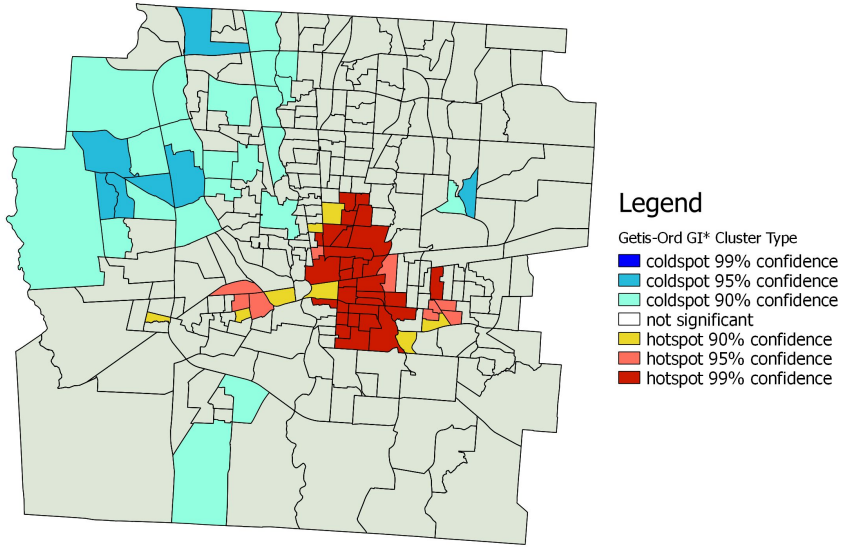


Cluster Analysis: Mean Imp. Surface Coverage

Left: Anselin Local Moran's I = high/low clusters & outliers

Right: Getis-Ord Gi* = hot/cold spots by likelihood

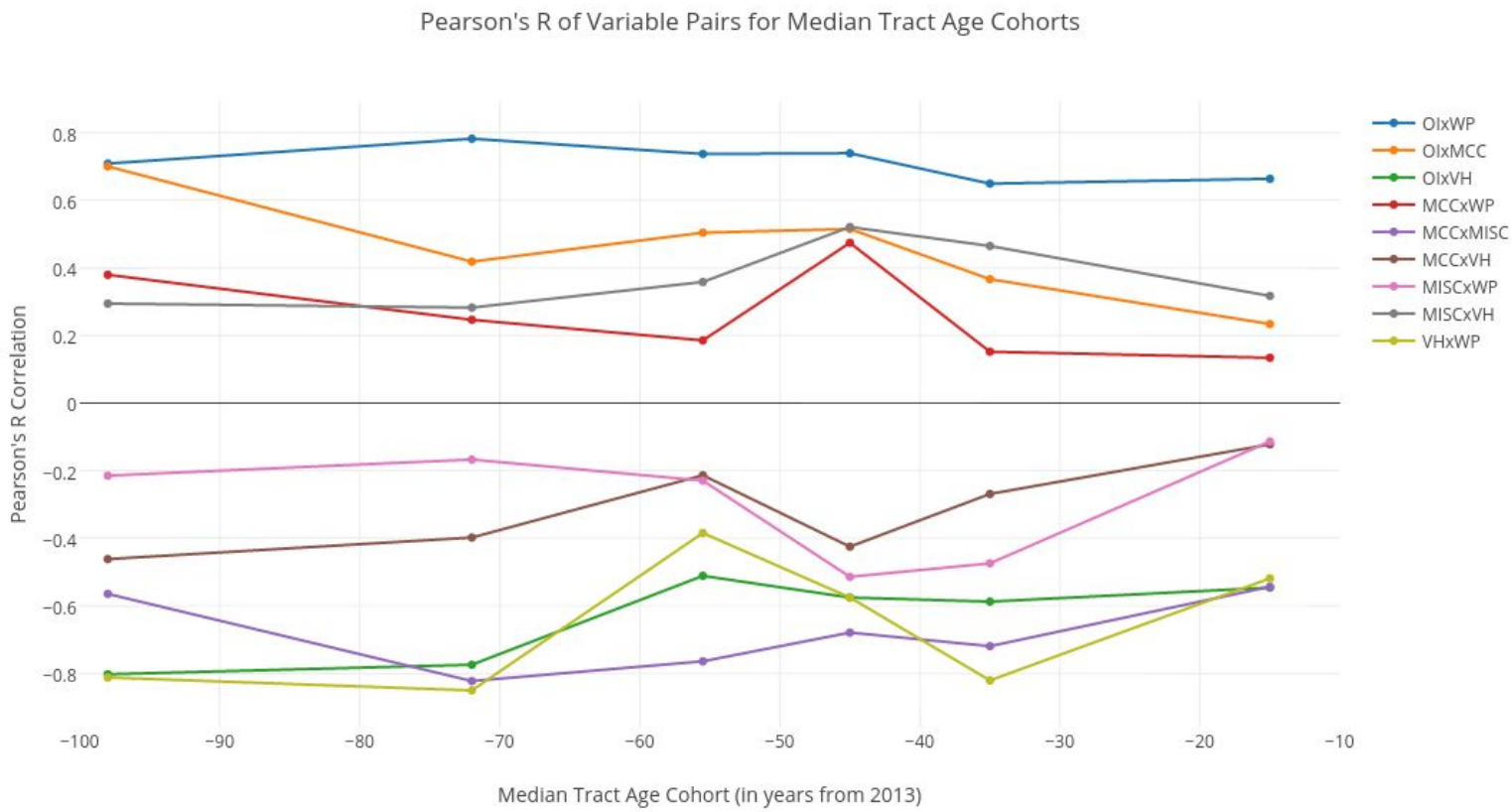




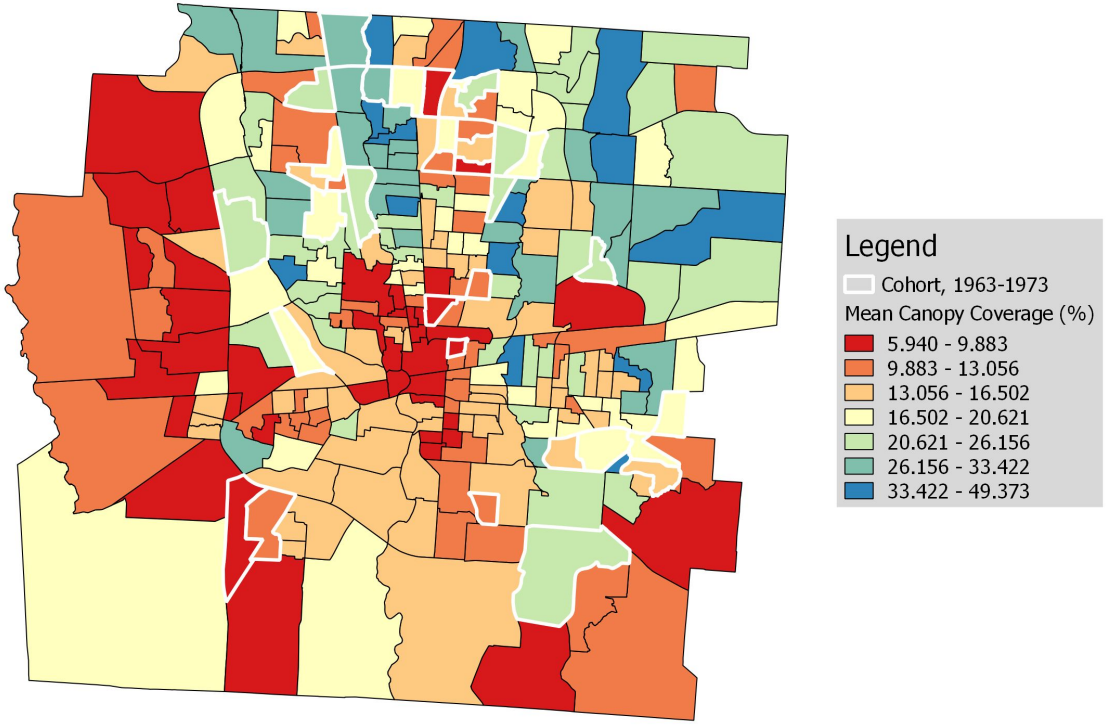
Cluster Analysis: Vacant Housing

Left: Anselin Local Moran's I = high/low clusters & outliers

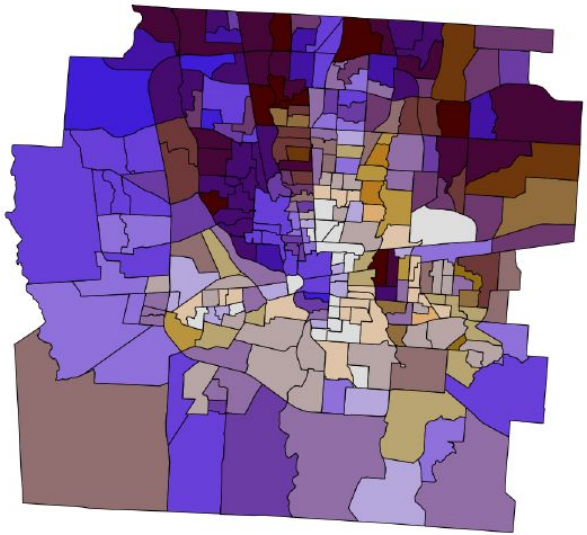
Right: Getis-Ord Gi* = hot/cold spots by likelihood

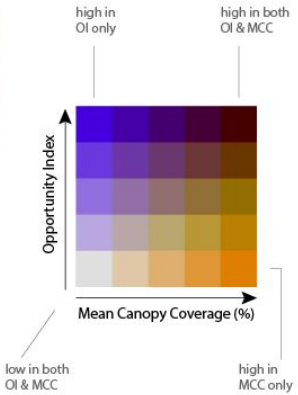


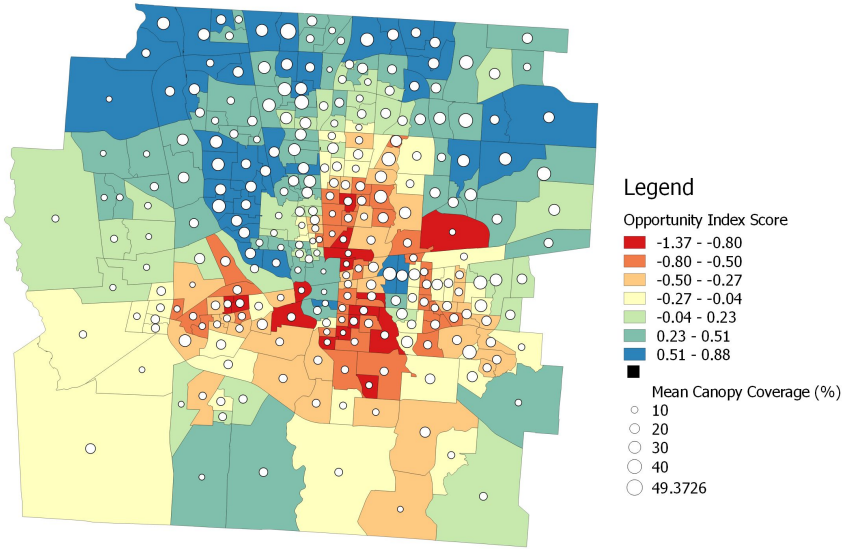
Age Cohort Correlation Analysis



Age Cohort Correlation Analysis

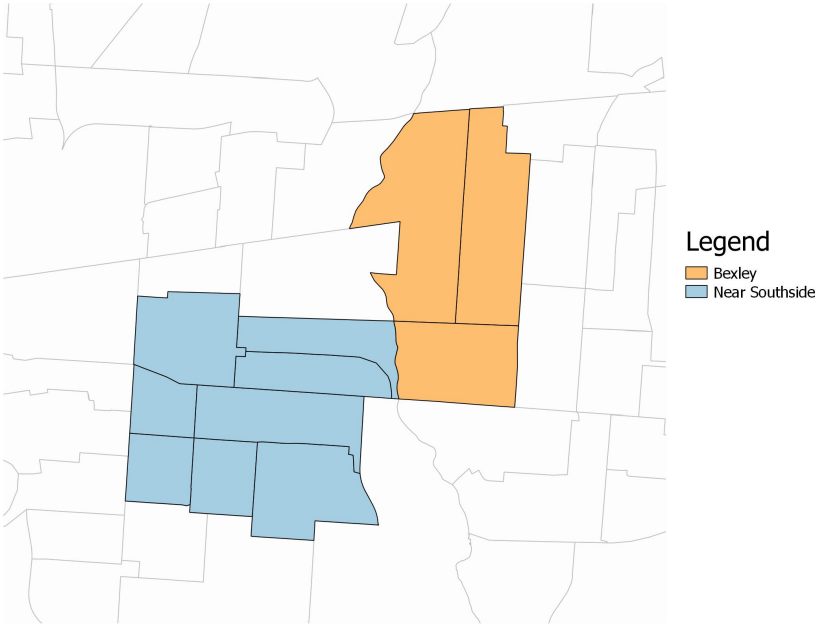




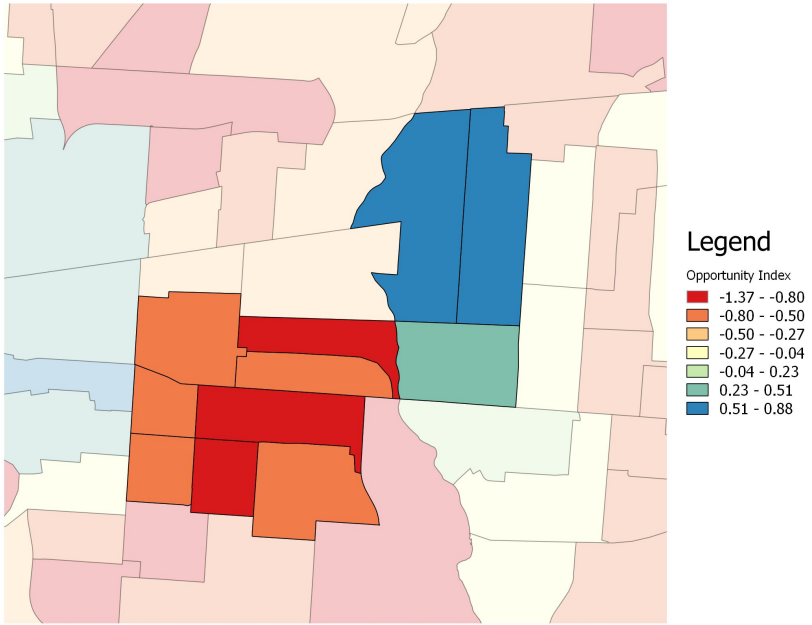


Bivariate Mapping

We were frustrated by the limited ability to explore bivariate maps meaningfully, though some trends could be seen.

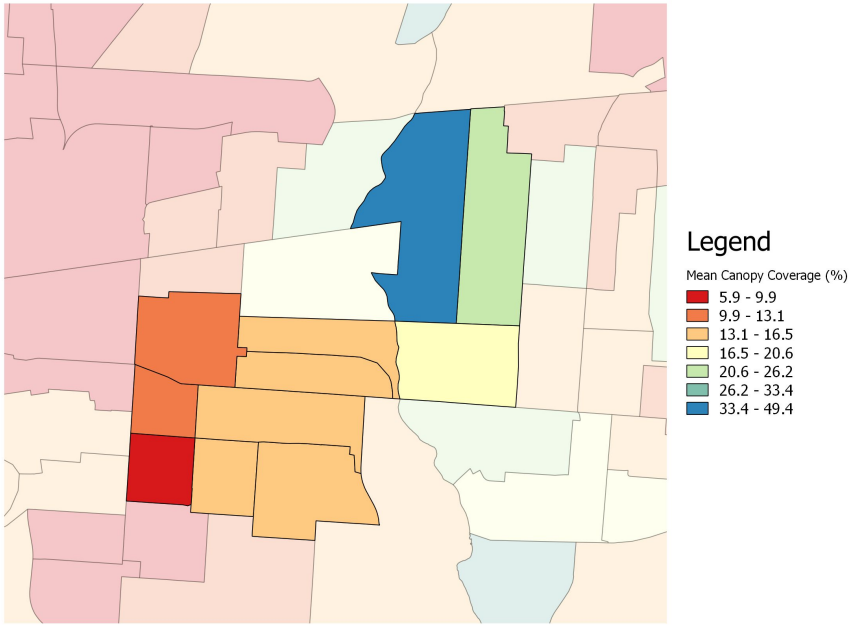


Areas

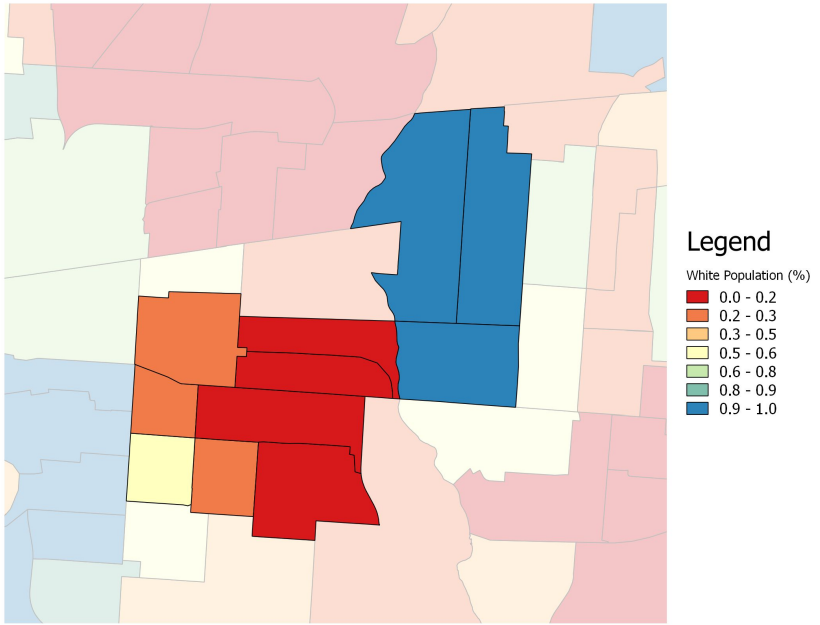


Opportunity Index

Case Study: Indicator Values

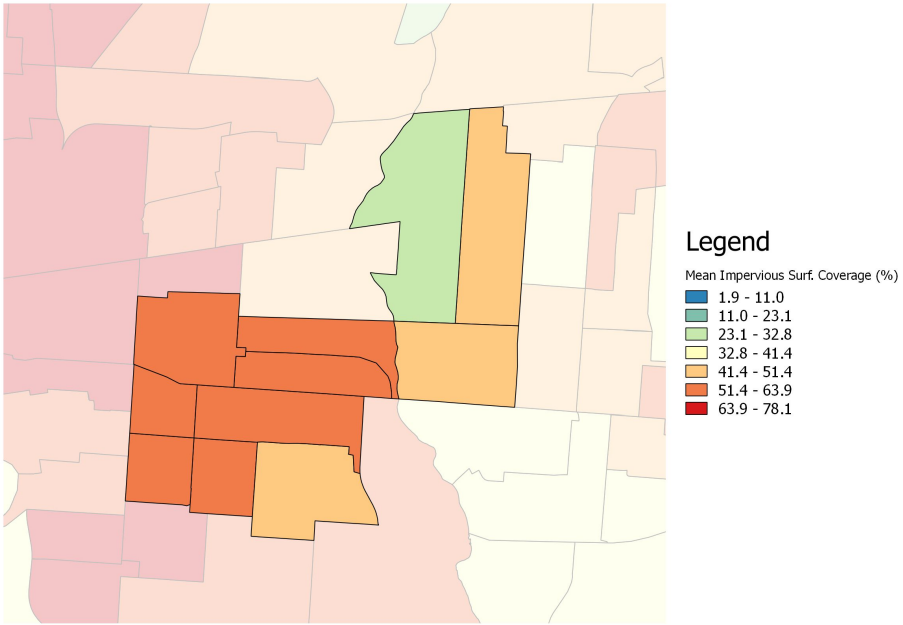


Mean Canopy Coverage

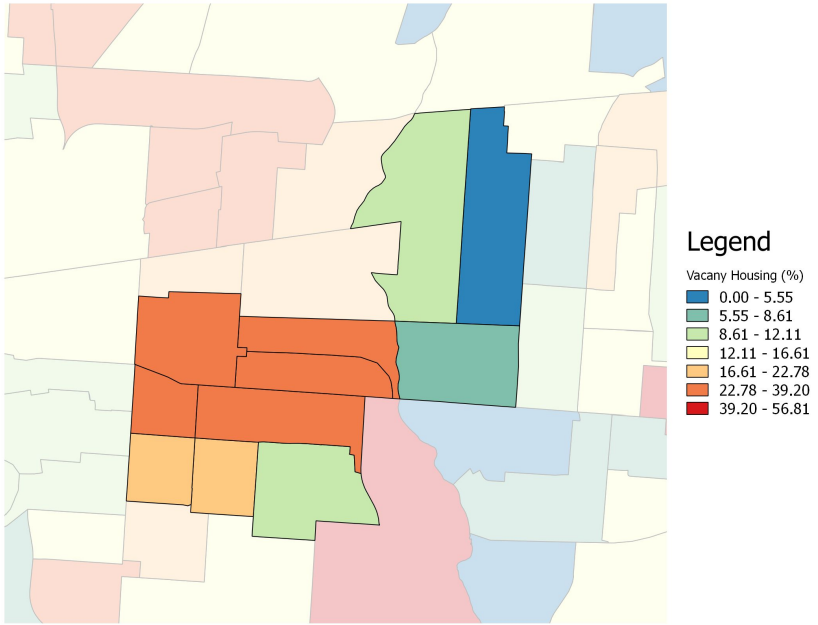


White Population

Case Study: Indicator Values



Mean Imp. Surface Coverage

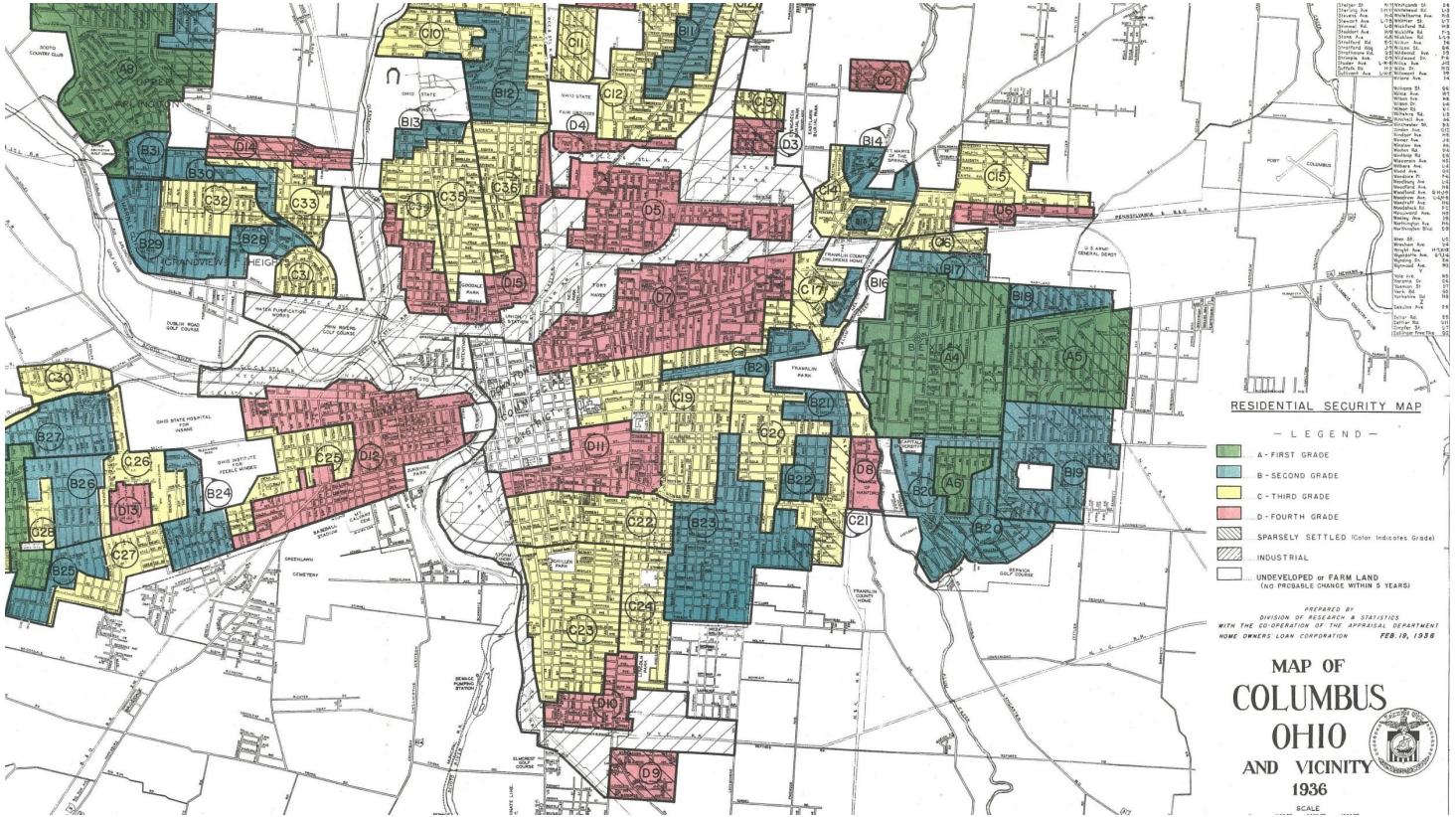


Vacant Housing

Case Study: Indicator Values

Policy	Effect
Redlining Identified neighborhoods as economically risky for mortgage loans, often by ethnicity.	Destabilized economy leads to disinvestment, economically and *environmentally.*
Restrictive Covenants Minorities seen as economic liability, disallowed from entering better neighborhoods.	Isolated minority populations, continual association of black space with bad environment.
Sacrificing Black Neighborhoods When I-70 is to be built through Columbus, it is the devalued neighborhoods which are acquired and demolished, even the improving ones.	Further frustration and destabilization in black residential areas, more extreme ethnic, economic, and environmental boundaries.

Case Study: Historical Analysis



Case Study: Redlining

1. Each of said Owners hereby agrees and binds himself, his heirs, executors, administrators and assigns, ***never to sell****, lease, mortgage, pledge, give or otherwise dispose of, in any way shape or form, the property above mentioned as owned by him, or any part thereof* ***to any colored person or persons.***

2. Each of the said Owners agrees and binds himself, his heirs, executors, administrators and assigns, including corporations and assigns in any capacity, never to rent said premises to any colored person or persons, or ***permit any colored person or persons to use or occupy the premises owned by him****, or any part thereof,* ***except as a servant*** *working for the white family or persons who occupy said premises.*

3. By the term "colored person" as used in this contract is meant "colored person" in the ordinary meaning of the words and any person in whole or in part of the negro race or blood, and ***any person than a member of the white or Caucasian race.***

4. Each Owner hereby agrees that he will not execute or enter into any contract for the sale of the real estate owned by his, as aforesaid, without providing in said contract that the same shall be ***void if the purchaser is a colored person.***

5. Each Owner hereby agrees that the agreements and covenants contained in this deed and contract shall and do run with the land...

6. All of the Owners for themselves, their heirs, executors administrators and assigns, agree that ***the ownership, occupancy or use by any colored person of any of the property above mentioned (except as a servant as above provided) constitutes and will constitute irreparable injury to the property*** *above mentioned and to the owners of said property at the time of such sale, ownership, use or occupancy, and each owner for himself and for his successors in title to said property, agrees and consents that the Court issue a permanent injunction restraining the transfer, sale, mortgage, or disposal of said property, or of any of the said properties, in violation of the provisions of this contract, or the rental, use or occupancy of said property or any one of said properties in violation of this contract.*

Source: http://www.dornberghouse.com/deed-restrictions.html

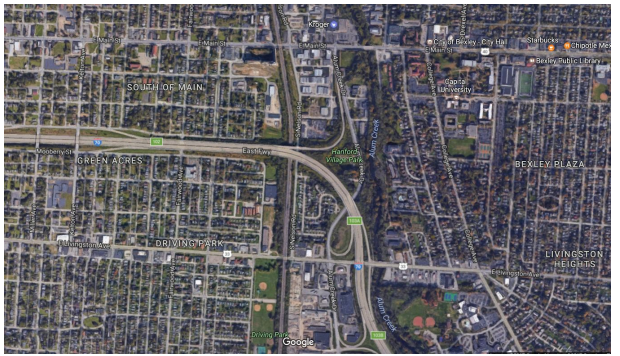
Case Study: Restrictive Covenants

1940's: GI Bill Black Homeownership
Hanford Village was one of the only notable areas marketed to black families, who settled from a nearby Air Force base.

1960's: South Bexley Spared, Hanford Village Demolished
When the up-and-coming neighborhood was less than 20 years old, it was bisected by I-70 construction, which removed its public park and incited disinvestment.

Devaluation Cycle Continues
Today Hanford Village enjoys a place on the Registrar of Historic Places which protects it somewhat from future razing. However, it stands as an example of devaluation preceding destabilization, which then reinforces the discrimination of black spaces.

Source: Arnett (2012)



Source: Google Maps (2017). maps.google.com.

Case Study: I-70 and Hanford Village

Discussion

1. Elaborating the relationship
2. The role of discrimination
3. Limitations of assessment
4. Next steps

“So is there a relationship?”

“Yes! But it seems really complex…”

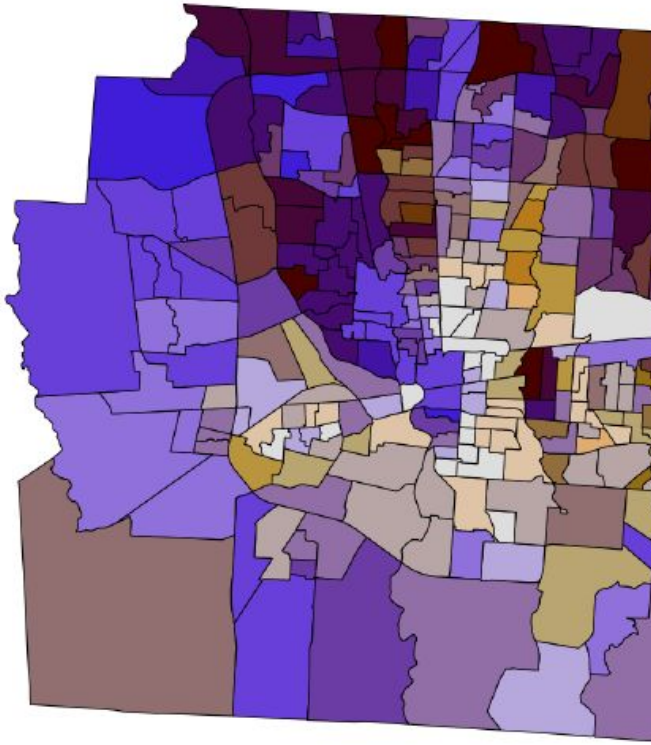
1. Elaborating the relationship

Introduction | Lit. Review | Methods | Analysis | **Discussion**

Environmental Assets Correlate
We showed that in Franklin County, OH tree canopy correlates with socioeconomic vitality as measured by OI.

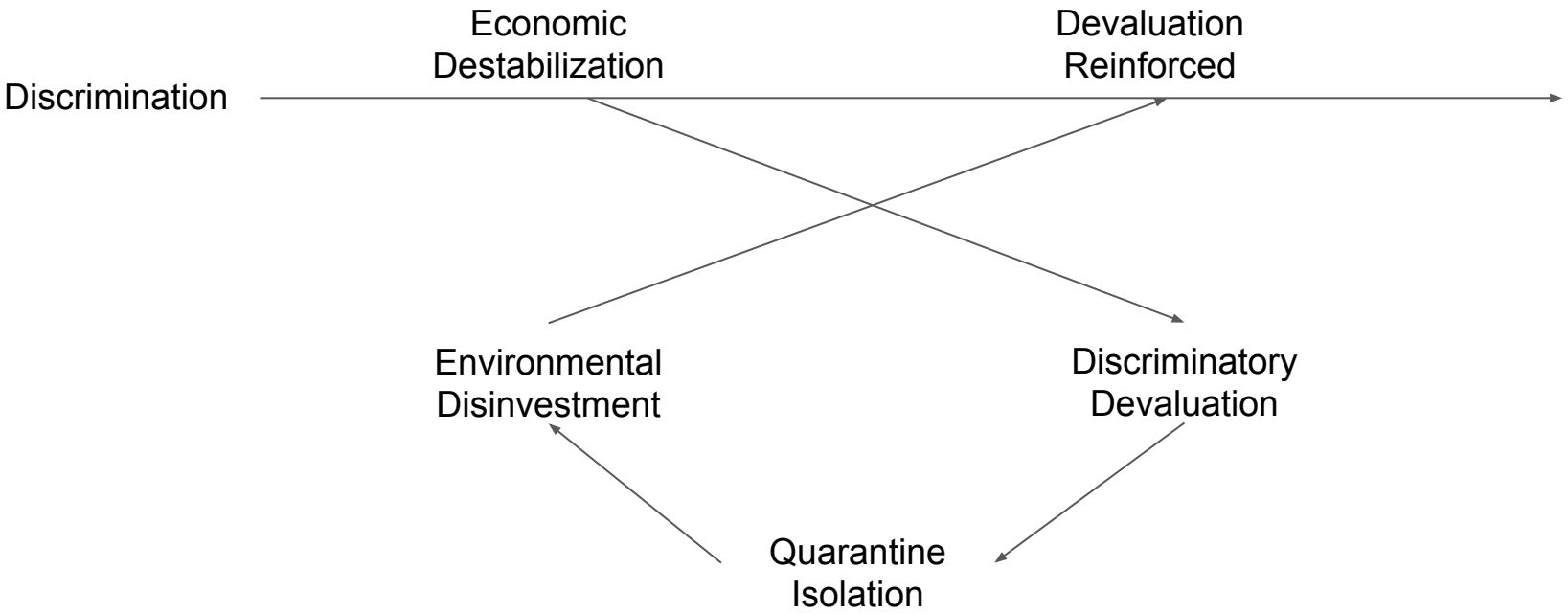
Picking Your Poison
The choice of assets and liabilities to measure depends on cultural values, biome, and many other factors.

Chicken-Egg Problem
More inquiry could be made into initial settlement patterns, environmental valuation, and discrimination. Do the rich neighborhoods lie on the old riverfronts, the farms, the old forests? And how have their environmental assets changed?



1. Elaborating the relationship

A Hypothetical Positive Feedback Loop of Environmental Disinvestment

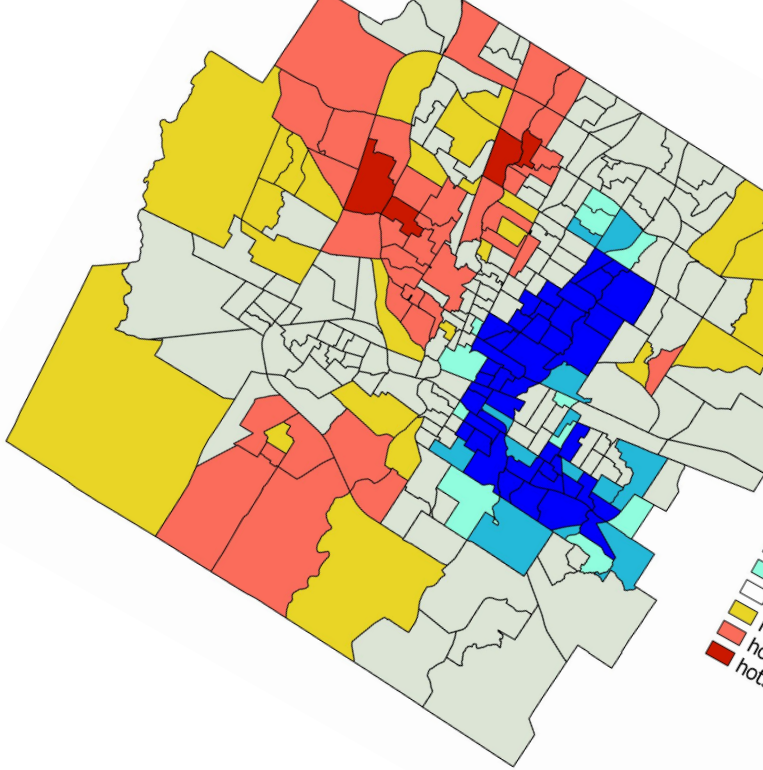


2. The role of discrimination

Theoretical Remoteness
Using remote data of indicators, you are often 4+ degrees of approximation removed from measuring the phenomena.

Perils of Bias
The redlining maps show what can happen when our assumptions are given clout in assessment systems.

Reading Tea Leaves
Concrete multivariate spatial analysis techniques, if they exist, were out of our reach, and we were left inferring trends from deceptively sharp maps of fuzzy measures.



3. Limitations of multivariate spatial assessment

True Multivariate Spatial Correlation
If this tool doesn't exist, I want to make it.

Refine Data Resolution
Toward the end of this research, we found that all values could have been calculated at the parcel level.

Work Toward Generalized Models
Urban canopy makes no sense as an environmental asset indicator for most of the world, but its role could be found in most cities. Find underlying theory of socialization of ecology.

4. Next steps

Thank You.

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Appendix